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Jawaharlal Nehru

“Step Out From the Old to the New”

IS 4159 (2002): Mineral Filled Sheathed Heating Elements  
[ETD 32: Electrical Appliances]

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“Knowledge is such a treasure which cannot be stolen”





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( तीसरा पुनरीक्षण )

*Indian Standard*

**MINERAL FILLED SHEATHED HEATING  
ELEMENTS — SPECIFICATION**

( *Third Revision* )

ICS 29.100.01, 97.100.01

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**BUREAU OF INDIAN STANDARDS**  
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG  
NEW DELHI 110002

**AMENDMENT NO. 1 MARCH 2005**  
**TO**  
**IS 4159 : 2002 MINERAL FILLED SHEATHED**  
**HEATING ELEMENTS — SPECIFICATION**

*( Third Revision )*

( *Page 1, clause 2, lines 2 and 3* ) — Substitute the following for the existing matter:

‘2.8 to 2.11, 2.13, 2.15, 2.17 to 2.20 and 2.23 to 2.28 not applicable.’

( *Page 1, clause 2.29 Replacement* ) — Substitute the following for the existing matter:

**‘Conditions of Adequate Heat Discharge**

Heating elements are installed according to manufacturers instructions, the tank being thermally insulated. Accessible parts of the heating element are not thermally insulated.

For the purpose of carrying out relevant tests under the conditions of adequate heat discharge the conditions are as specified in 11.2, 11.4 and 11.101.’

( *Page 1, after clause 2.29 and before ‘Additional Subclause’* ) — Delete 2.19 and 2.20.

[ *Page 2, clause 7.1(c)*] — Substitute ‘input’ for ‘output’.

( *Page 2, clause 7.1* ) — Add the following after ‘(e)’ :

‘f) Sheathing material in case of aluminium.’

( *Page 2, clause 8* ) — Substitute the following for the existing matter:

‘This clause of IS 302-1 is applicable only for heating elements where the terminals are enclosed in a cover.’

( *Page 2, clause 11* ) — Substitute the following for the existing matter:

**‘11 TEMPERATURE RISE**

This clause of IS 302-1 is applicable except as follows:

**Amend No. 1 to IS 4159 : 2002**

**11.2 Addition**

In case of heating element for water heating, the tank is filled with water to at least 10 mm above the highest point of heating element or the highest level allowed by the construction. The heating element is operated at 1.15 times the rated power input with all controls in the circuit. The water temperature shall not exceed 98°C.

**11.4 Addition**

Heating element for oil heating shall be fitted with all controls and filled with oil of following properties in an appropriate container so designed that the temperature of the heating medium does not go beyond the values specified for the particular grade of oil.

Oil	Maximum Temperature of the Heating Medium C
Grade LV fuel oil ( see IS 1593) and coal tar fuel of viscosity 60 to 100 Redwood No. 1 sec at 37.8°C	176.7
Grade MV fuel oil ( see IS 1593) and coal tar fuel of viscosity 1 000 to 1 500 Redwood No. 1 sec at 37.8°C	193.7
Grade HV fuel oil ( see IS 1593) and coal tar fuel of viscosity 70 to 120 Standard tar viscometer sec at 30°C	210.0

**11.5 and 11.6 Not applicable**

**11.8 Addition**

In case of oil-immersion heating element, the temperature at any point on the surface should not be high as to constitute a fire hazard or to damage any material employed in the heater and the temperature rise at specified part shall not exceed the values indicated in Table 1 of IS 302-1.

**11.9 and 11.10 Not applicable.**

*Additional subclause*

**11.101** Heating elements meant for air heating are placed at a distance of 15 cm from the face and wall of the test corner in the most unfavourable position for a period of 30 min.

**Amend No. 1 to IS 4159 : 2002**

**Table 1 Addition**

The heating element shall be operated in accordance with the manufacturers instructions with the surface temperature at  $350^{\circ} \pm 20^{\circ}\text{C}$  for sheathing made out of aluminium material and  $500^{\circ} \pm 20^{\circ}\text{C}$  for other materials.

( *Page 3, clause 18.1, Note, second line* ) — Substitute '2.0 to 2.5 litres' for '20 to 25 litres'.

( *Page 3, clause 19, second line* ) — Substitute '19.1(b) and (d)' for '19.1(b), (c) and (d)'.

( *Page 3, clause 19.2, Para 1 Replacement* ) — Substitute the following for the existing matter:

'Heating elements are tested under the conditions specified in 11 but without heat discharge. The supply voltage determined prior to the test is that required to provide a power input of 0.85 times rated power input under above conditions when the power input has stabilized. This voltage is maintained throughout the test.

Heating elements for water heating are operated with tank empty under steady state conditions given in 11.2 for a period of 30 min.

Test on oil heating element is carried out after mounting the same in the container specified in 11.4 but in dry conditions obtained by draining out the oil from the container.

Heating elements for air heating are tested under the conditions specified in 11.101.'

( *Page 3, clause 19.3* ) — Substitute 'Replacement' for 'Addition' and substitute the following for the existing matter:

'The test of 19.2 is repeated. The heating elements shall be tested under the conditions of adequate heat discharge specified in 11.2 for water heaters, 11.4 for oil heaters and 11.101 for air heaters.'

( *Page 4, clause 25.1, third line* ) — Substitute 'or' for 'of'.

( *Page 4, clause 27.1* ) — Substitute the following for the existing matter:

'This clause of IS 302-1 is applicable if earthing terminal is provided.'

**Amend No. 1 to IS 4159 : 2002**

( *Page 4, clause 101.1, second line* ) — Substitute 'one sample' for 'two samples'.

( *Page 4, Table 101* ) — Insert the following as 'xiii'):

'xiii) Internal wiring 23'

( *Page 5, clause 101.1.1, first line* ) — Substitute 'The sample' for 'Both samples'.

( *Page 5, clause 101.1.1, third line* ) — Substitute 'If the sample' for 'If any of the samples'.

(ET 32)

Reprography Unit, BIS, New Delhi, India

**AMENDMENT NO. 2 AUGUST 2006  
TO  
IS 4159 : 2002 MINERAL FILLED SHEATHED  
HEATING ELEMENTS — SPECIFICATION**

*(Third Revision)*

[ *Page 2, clause 11.8, Addition (see also Amendment No. 1)* ] — Add the following at the end:

‘The heating element shall be operated in accordance with the manufacturer’s instructions with the surface temperature not exceeding 350°C for aluminium sheathing and 500°C for other sheathing material.’

[ *Page 2, Table 1, Addition (see also page 3 of Amendment No. 1)* ] — Delete.

[ *Page 3, clause 19.2, Para 1, Replacement (see also Amendment No. 1)* ] — Substitute the following for the existing matter:

‘Heating elements are tested under the condition specified in 11.1 but with restricted heat dissipation (surface temperature not exceeding 350°C for aluminium sheathing and 500°C for other sheathing material). The supply voltage determined prior to the test is that required to provide a power input of 0.85 times rated power input under the above conditions when the power input has stabilized. This voltage is maintained throughout the test.

Heating elements for water heating are operated with tank empty under steady state conditions specified in 11.2 for a period of 30 min.

Test on oil heating element is carried out after mounting the same in the container specified in 11.4 but in dry condition. Dry condition can be achieved by draining out the oil from the container.

Heating elements for air heating are tested under the conditions specified in 11.101.’

( ET 32 )

## FOREWORD

**This Indian Standard (Third Revision) was adopted by the Bureau of Indian Standards, after the draft finalized by the Electrical Appliances Sectional Committee had been approved by the Electrotechnical Division Council.**

**This standard was originally published in 1967. The first revision was brought out in 1976 to expand the scope of the standard to include immersion heating elements for oil heaters. The second revision was brought out in 1983. This third revision has been undertaken primarily to align with IEC publication on fixed immersion water heater and also to take into account seven amendments so far issued to this standard. For the sake of convenience of reference, the format of the standard has been based on IS 302-1(1979).**

**Mineral filled sheathed heating elements are used in heating appliances, such as immersion heaters, cooking appliances, kettles and oil heaters. This standard covers general and safety requirements of these elements so as to ensure reliable operation, safety against electric shock, and safety against excessive temperature and fire.**

**This standard is to be read in conjunction with IS 302-1(1979). For the sake of convenience, the clauses of this standard correspond to those of IS 302-1(1979), clauses which are applicable (which means that relevant provisions of that clause apply) or not applicable and necessary changes, wherever required are indicated accordingly. Clauses/Tables which are additional to those of IS 302-1(1979) are numbered starting from 101. Should however, any deviation exist between IS 302-1(1979) and this standard, the provisions of the latter shall apply.**

**Indian Standards, which are necessary adjunct to this standard, are given in Annex A.**

**While preparing this standard, assistance has been derived from the following:**

**IEC Pub 335-1 (1991) Safety of household and similar electrical appliances—Part 1: General requirements issued by the International Electrotechnical Commission**

**IEC Pub 335-2-73 (1994) Safety of household and similar electrical appliances—Part 2: Particular requirements for fixed immersion heaters issued by the International Electrotechnical Commission**

**UL Specification 574 Electric oil heaters issued by Underwriters Laboratories Inc. USA.**

**The manufacture of heating elements with double or reinforced isolation has not yet started in this country and hence this standard does not cover requirements for such types of heating elements.**

**In order to ensure safety to the user, manufacturers of appliances shall ensure that suitable protective devices are incorporated in the appliances.**

**For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test, shall be rounded off in accordance with IS 2 : 1960 'Rules for rounding of numerical values (revised)'. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.**

*Indian Standard***MINERAL FILLED SHEATHED HEATING ELEMENTS — SPECIFICATION***(Third Revision)***1 SCOPE**

This clause of IS 302-1 is applicable except as follows:

**1.1 Replacement**

This standard covers the requirements and methods of test for mineral filled sheathed heating elements for household and similar purposes intended for installation in a container, designed to operate under specified operating conditions and meant for use in heating appliances, such as water heaters, cooking appliances, kettles, oil heaters, and air heaters having air, water or oil as heating medium.

**2 TERMINOLOGY**

This clause of IS 302-1 is applicable except as follows:

**2.8 to 2.11, 2.13, 2.15, 2.17, 2.18 and 2.23 to 2.28** Not applicable.

**2.29 Replacement****Conditions of Adequate Heat Discharge**

Heating element are installed according to manufacturers instructions, the tank being thermally insulated. Accessible parts of the heating element is not thermally insulated.

For the purpose of carrying out relevant test under the condition of adequate heat discharge following conditions shall apply:

- Heating elements used for water heating shall be installed in an appropriate container filled with water as per manufacturer's instruction with all controls in circuit.
- Heating elements meant for air heating shall be installed as per manufacturer's instructions and shall be fitted with all controls in circuit.
- Heating element for oil heating shall be installed in an appropriate container and shall be fitted with all controls and filled with oil of following properties.
- The heating element shall be operated in accordance with the manufacturers instructions. Maximum surface temperature not exceeding  $350^{\circ}\text{C} \pm 20^{\circ}\text{C}$  for sheathing made out of aluminium material and  $500^{\circ}\text{C} \pm 20^{\circ}\text{C}$  for other materials.

<i>Oil</i>	<i>Maximum Temperature of the Heating Medium °C</i>
Grade LV fuel oil (see IS 1593) and coal tar fuel of viscosity 60 to 100 Redwood No. 1 sec at $37.8^{\circ}\text{C}$	176.7
Grade MV fuel oil (see IS 1593) and coal tar fuel of viscosity 1 000 to 1 500 Redwood No. 1 sec at $37.8^{\circ}\text{C}$	193.7
Grade HV fuel oil (see IS 1593) and coal tar fuel of viscosity 70 to 120 Standard tar viscometer sec at $30^{\circ}\text{C}$	210.0

**2.19, 2.20, 2.30, 2.31, 2.33, 2.37 to 2.42, 2.45 and 2.46**  
Not applicable.

*Additional Subclause***2.101 Mineral Filled Sheathed Elements**

Heating element having one or more heating resistors embedded in mineral insulating material (such as magnesium oxide) and enclosed within a metallic sheath or sheaths.

**3 GENERAL REQUIREMENTS**

This clause of IS 302-1 is applicable except as follows:

**3.1 Para 2 Replacement**

In general, compliance is checked by carrying out the relevant tests specified.

**4 GENERAL NOTES ON TEST**

This clause of IS 302-1 applicable except as follows:

**4.2 Note 3 and Note 4** Not applicable.

**4.8, 4.10, 4.11, 4.13, 4.14 and 4.19** Not applicable.

## 5 RATING

This clause of IS 302-1 is applicable except as follows:

5.1.1 Not applicable

### 5.2.1 *Replacement*

The rated inputs shall be preferably chosen from 250, 500, 750, 1 000, 1 250, 1 500, 2 000, 2 500, 3 000, 4 000 and 5 000 W.

5.2.2 and 5.2.3 Not applicable.

## 6 CLASSIFICATION

This clause of IS 302-1 is applicable except as follows:

6.1(a)(2), 6.1 (a)(3), 6.1(b)(2), 6.1(b)(3) and 6.1(b)(4) Not applicable.

## 7 MARKING

This clause of IS 302-1 is applicable except as follows:

### 7.1 *Replacement*

Heating elements shall be marked with the following information:

- a) Name of the manufacturer or trade-mark or identification mark;
- b) Rated voltage in volts;
- c) Rated output in W or kW;
- d) Oil pressure rating (in case of oil heating elements); and
- e) Country of manufacture.

NOTE — Additional marking are allowed, provided they do not give rise to misunderstanding.

7.2, 7.3.1, 7.7, 7.8, 7.9 and 7.10 Not applicable.

### 7.12 *Replacement*

An instruction sheet giving necessary instructions including precautions to be taken for the proper use of heating element shall be provided.

7.14 Para 3, 5 and 6 Not applicable.

### *Additional Subclause*

7.101 The heating element may also be marked with the Standard Mark.

NOTE — The use of the Standard Mark is governed by the provisions of the *Bureau of Indian Standards Act, 1986* and the Rules and Regulations made thereunder. The details of conditions under which the licensee for the use of the Standard Mark may be granted to manufacturers and producers may be obtained from the Bureau of Indian Standards.

## 8 PROTECTION AGAINST ELECTRIC SHOCK

This clause of IS 302-1 is applicable only for heating elements with cover.

8.2, 8.3, 8.5 to 8.9 Not applicable.

## 9 STARTING OF MOTOR-OPERATED APPLIANCES

This clause of IS 302-1 is Not applicable.

## 10 INPUT AND CURRENT

This clause of IS 302-1 is applicable except as follows.

10.2 and 10.3 Not applicable.

## 11 TEMPERATURE RISE

This clause of IS 302-1 is applicable except as follows:

11.5 and 11.6 Not applicable.

### 11.8 *Addition*

In case of oil-immersion heating element, the temperature at any point on the surface should not be high as to constitute a fire hazard or to damage any material employed in the heater and the temperature rise at specified part shall not exceed the values indicated in Table 1 of IS 302-1.

11.9 and 11.10 Not applicable

## 12 OPERATION UNDER OVERLOAD CONDITIONS OF APPLIANCES WITH HEATING ELEMENTS

This clause of IS 302-1 is applicable except as follows:

12.2 Para 1, 2, 3 and Note 2 Not applicable.

12.3 Not applicable.

## 13 ELECTRICAL INSULATION AND LEAKAGE CURRENT AT OPERATING TEMPERATURE

This clause of IS 302-1 is applicable.

## 14 RADIO AND TELEVISION INTERFERENCE SUPPRESSION

This clause of IS 302-1 Not applicable.

## 15 MOISTURE RESISTANCE

This clause of IS 302-1 is applicable except as follows:

15.2.1, 15.2.2, 15.2.3 and 15.3 Not applicable.

## 16 INSULATION RESISTANCE AND ELECTRIC STRENGTH (AFTER HUMIDITY TREATMENT)

This clause of IS 302-1 is applicable except as follows:

16.3 Not applicable.

## 17 OVERLOAD PROTECTION

This clause of IS 302-1 Not applicable.

## 18 ENDURANCE

This clause of IS 302-1 is applicable except as follows:

### 18.1 Para 3 and 4 Replacement

The element shall be subjected to this test in the medium for which it is designed under the conditions of adequate heat discharge. The element shall be operated at 1.15 times the rated input for 96 operating hours. At the end of the test, the element shall be checked for high voltage test of 16.4.

NOTE — In the case of heating element for water heating, the quantity of water in the tank shall be 20 to 25 litres per 100 W. The water being initially at the ambient temperature.

### 18.2 to 18.5 Not applicable.

## 19 ABNORMAL OPERATION

This clause of IS 302-1 is applicable except as follows:

### 19.1 (b), (c) and (d) Not applicable.

### 19.2 Para 1 Replacement

Heating elements shall be tested under the condition specified in 2.29 (d) for a period of 30 min.

### 19.3 Addition

In the case of heating elements for water heating, the test of 19.2 is repeated, the tank being filled with water to at least 10 mm above the highest point of heating element or the highest level allowed by the construction. The heating element is operated at 1.15 times the rated power input. The water temperature shall not exceed 98°C.

NOTE — In case of thermally insulated tank it may not be placed inside the test corner.

## 20 STABILITY AND MECHANICAL HAZARDS

This clause of IS 302-1 is applicable except as follows:

### 20.1 Replacement

Heating elements and their accessories shall have no sharp edges, burrs or the like which might cause injury to the user, other than those necessary for the function of the heating element.

Compliance is checked by inspection.

### 20.2 Not applicable

## 21 MECHANICAL STRENGTH

This clause of IS 302-1 is applicable.

## 22 CONSTRUCTION

This clause of IS 302-1 is applicable except as follows:

22.4, 22.12, 22.15, 22.18, 22.20, 22.22, 22.24, 22.27, 22.29 to 22.32 Not applicable.

### Additional Subclauses

22.101 The resistance wire used for the heating element shall be located centrally within the casing

in such a manner as to prevent any relative movement or contact between the element wire and the casing and shall be so arranged as to maintain effective electrical contact with the connecting leads. Connections between the terminals and the element shall be made in a secure and durable manner.

22.102 The watt density for oil heaters shall be as agreed to between the purchaser and the manufacturer.

22.103 Heating elements may be provided with automatic temperature control and non-self re-setting thermal cut-out.

NOTE — The automatic temperature control/cut-out may be either supplied along with the heating element or may be procured separately. However, in latter case, arrangement for fitting the automatic temperature control device on heating element shall be provided by the manufacturer of the heating element for oil.

22.104 A part in contact with liquid shall be resistant to the action of such liquid.

22.105 For any rubber part in contact with liquid when subjected to immersion test according to IS 3400 (Part 6), the change in volume shall not be more than 25 percent swelling or one percent shrinkage and the weight loss (extraction) shall not be more than 10 percent. The test should be made in the liquid for which the immersion heating element is meant.

22.106 An automatically actuated part of liquid heating element shall be made of metal resistant to corrosion or of metal protected by a corrosion resistant finish that will not be impaired by exposure, wear, etc, expected service life of the heater.

22.107 Any sheath, capillary, well or other part shall be adequately resistant to attack by the oil it may normally come in contact in service where failure of the part may permit external leakage or cause unsafe operation.

22.108 For oil heaters uncoated non-stainless ferrous material are considered to satisfy the requirements specified in 22.107 when made of sheet metal not less than 0.4 mm in thickness. Brass alloys in sheet form are not considered resistant to the corrosive, effects of fuel oils.

22.109 If warping of a casting may affect the tightness of liquid-confining joints or the necessary fit of parts, the casting shall be stress relieved to reduce the possibility of warping to a minimum.

22.110 For flat flanges, a vegetable-fiber gasket shall be not less than 0.8 mm thick. Synthetic rubber gaskets shall have a thickness of not less than 1.6 mm.

### 23 INTERNAL WIRING

This clause of IS 302-1 is applicable except as follows:  
23.1, 23.4 to 23.8 Not applicable.

### 24 COMPONENTS

This clause of IS 302-1 is applicable except as follows:

#### 24.2 Replacement

Heating element shall not be fitted with:

- a) switches in flexible cable or cords;
- b) devices which, in the event of a fault in the appliance cause the interruption of the supply by applying a short circuit;
- c) thermal cut-outs that can be re-set by a soldering operation; and
- d) self re-setting thermal cut-outs.

24.3 to 24.10 Not applicable.

### 25 SUPPLY CONNECTION AND EXTERNAL FLEXIBLE CABLES AND CORDS

This clause of IS 302-1 is applicable except as follows:

#### 25.1 Replacement

Heating element shall be provided with a means of connection to supply, in the form of a set of terminals of supply leads.

25.3 to 25.14 Not applicable

### 26 TERMINALS FOR EXTERNAL CONDUCTORS

This clause of IS 302-1 is applicable.

### 27 PROVISION FOR EARTHING

This clause of IS 302-1 is applicable except as follows:

#### 27.1 Addition

The test is applicable wherever earthing terminal is provided.

### 28 SCREWS AND CONNECTIONS

This clause of IS 302-1 is applicable in case of screw type terminals.

### 29 CREEPAGE DISTANCES OF CLEARANCES

This clause of IS 302-1 is applicable except as follows:

29.2 and 29.3 Not applicable.

### 30 RESISTANCE TO HEAT, FIRE AND TRACKING

This clause of IS 302-1 is applicable.

### 31 RESISTANCE TO RUSTING

This clause of IS 302-1 is applicable except as follows:

#### 31.1 Addition

NOTE—The ferrous parts which form a part of heating element wire shall not be subjected to this test.

### 32 RADIATION HAZARDS

This clause of IS 302-1 Not applicable.

### 33 FINISH

This clause of IS 302-1 is applicable except as follows:

#### 33.1 Replacement

The external finish used on metal components shall be of non-hazardous and also of heat and moisture resisting nature and shall not be adversely affected by variation in temperature occurring under normal operating conditions or after the endurance test.

Compliance shall be checked by visual inspection after endurance test.

#### 33.2 Not applicable

### 101 TESTS

#### 101.0 Categories of Tests

Tests are classified as type, acceptance and routine tests.

#### 101.1 Type Tests

The test specified in Table 101 shall constitute the type tests and shall be carried out on two samples of heating element selected preferably at random from a regular production lot. Before commencement of the tests, the heating elements shall be visually examined and inspected for obvious visual defects in respect of components, parts and their assembly, construction, mechanical hazards, marking and provision of suitable terminals for supply connections.

**Table 101 Schedule of Type Tests**  
(Clause 101.1)

SI No.	Test	Clause Reference
(1)	(2)	(3)
i)	Protection against electric shock	8
ii)	Input	10
iii)	Temperature-rise	11
iv)	Operation under overload condition	12
v)	Electrical insulation and leakage current at operating temperature	13
vi)	Moisture resistance	15
vii)	Insulation resistance and electric strength (after humidity treatment)	16
viii)	Endurance	18
ix)	Abnormal operation	19
x)	Stability and mechanical hazard	20
xi)	Mechanical strength	21
xii)	Construction	22
xiii)	Components	24
xiv)	Supply connection and external flexible cables and cords	25
xv)	Terminals for external conductors	26
xvi)	Provision for earthing	27
xvii)	Screws and connection	28
xviii)	Creepage distances and clearances	29
xix)	Resistance to heat, fire and tracking	30
xx)	Resistance to rusting	31
xxi)	Finish	33
xxii)	Leakage and hydrostatic strength (for immersion oil heating elements)	102

**101.1.1 Criteria of Acceptance**

Both samples shall successfully pass all the type tests for proving conformity with the requirements of the standard. If any of the samples fails in any of the type tests, the testing authority, at its discretion, may call for fresh samples not exceeding twice the original number and subject them again to all tests or to the test(s) in which failure(s) had occurred. No failure should be permitted in the repeat test(s).

**101.2 Acceptance Test**

The following shall constitutes the acceptance tests:

Test	Clause Reference
a) Protection against electric shock	8
b) Input	10
c) Temperature-rise	11
d) Insulation resistance electric strength at operating temperature	13
e) Moisture resistance	15
f) Insulation resistance and electric strength (after humidity treatment)	16
g) Earthing connection	27
h) Leakage and hydrostatic strength test	102.3

NOTE — For the purpose of acceptance test, the humidity treatment shall be of 24 h.

**101.2.1** A recommended sampling procedure for acceptance tests is given in Annex B of IS 302-1.

**101.3 Routine Tests**

The following shall constitute the routine tests:

Test	Clause Reference
a) Protection against electric shock	8
b) Input	10
c) High voltage	13.3.2 of IS 302-1
d) Leakage and hydrostatic strength (for oil heating elements)	102.3

NOTE — Before commencement of the test, the heating elements shall be visually examined and inspected for obvious visual defects in respect of components, parts and their assembly, construction, mechanical hazards, markings and provision of suitable terminals for supply connections.

**102 LEAKAGE AND HYDROSTATIC STRENGTH TEST**

**102.1** All parts of an oil heater which are subjected to liquid pressure during normal usage shall withstand, without leakage, a hydrostatic pressure of one-and-a-half times the rated pressure of the assembly and without rupture or permanent distortion, a hydrostatic pressure of five times the rated pressure of the assembly, but not less than 420 kPa

**102.2** A representative sample of the largest assembly shall be used for this test. If both screwed and flanged type mountings are furnished, a sample of each type is to be tested.

**102.3** Hydrostatic pressure is to be applied and uniformly increase up to one-and-a-half times rated pressure and maintained for a period of at least one minute. No leakage of test liquid is to occur during the period.

**102.4** Hydrostatic pressure is uniformly increased up to five times rated pressure, but not less than 420 KPa ( $4.2 \text{ kg/cm}^2$ ) and maintained for one additional minute.

**ANNEX A**

*(Foreword)*

**LIST OF REFERRED INDIAN STANDARDS**

IS No.	Title	IS No.	Title
302-1 (1979)	General and safety requirements for household and similar electrical appliances (fifth revision)	3400	Method of test for vulcanized (Part 6) : 1983 rubbers: Part 6 Resistance to liquids (first revision)
1593 : 1982	Fuel oil (second revision)		

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This Indian Standard has been developed from Doc: No. ET 32 ( 5041 ).

### Amendments Issued Since Publication

Amend No.	Date of Issue	Text Affected

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60 20 25

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{ 254 12 16, 254 14 42  
254 25 19, 254 13 15

Western : Manakalaya, E9 MIDC, Marol, Andheri (East)  
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